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RESEARCH ARTICLE

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Crime location choices: A geographical analysis of German serial killers

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Abstract

The present study examined whether there are different processes operating in the crime location choices between body-disposing and non-body-disposing serial killers and between sexual serial killers and acquisitive serial killers. A sample of 49 series of solved German serial killings is used to examine the differences in travelled distances between these groups of killers. Nonparametric tests revealed that body-disposing and non-body-disposing serial killers and sexual and acquisitive serial killers did not constitute subgroups of serial killers regarding their spatial behaviour. The results suggest that the compared groups are subjected to the same factors that influence their travelled distances. Furthermore, the possible role of planning and anticipated emotions in crime location choices of serial killers is discussed, as well as the limitations of the study and recommendations for future research.

KEYWORDS

serial murder, geographic profiling, journal to crime, offender decision making

1 | INTRODUCTION

Research into spatial offender behaviour has shown that crime locations and location choice are not random, instead some form of conscious or unconscious decision making or choice is involved (Canter, 2007; Canter & Youngs, 2009; Lunnigan & Canter, 2001a, 2001b; O'Connell & Synnott, 2009). When offenders chose the crime locations, they are influenced by the same universal processes that influence people's spatial everyday life behaviour (Canter, 2004, 2007; Canter, Coffey, Huntley, & Missen, 2000; Canter & Youngs, 2009; Synnott, Canter, Youngs, & Ioannou, 2016), which commonly being experience and knowledge of the area (Beauregard, Proulx, Rossmo, Leclerc, & Allaire, 2007; Bernasco, 2010; Breetzke, 2012; Van der Kemp & Van Koppen, 2007).

Therefore, it is highly likely that this leads to a perpetual process (Canter & Youngs, 2009), suggesting that offenders' crime location choices and judgements regarding costs and benefits are influenced by their knowledge/experience of their activity space, which in turn will influence where someone will travel to achieve a preconceived goal.

Serial killings are commonly committed further from offenders' home than other types of crimes (Lundrigan & Canter, 2001a). One way to investigate if some form of conscious decision-making process is involved in the spatial behaviour of serial killers is through body-disposal locations, which has psychological significance (Lundrigan & Canter, 2001a). According to Snook, Cullen, Mokros, and Harbort (2005, p. 152), the body-disposal-site choice "may involve a more conscious decision-making process" than the place where the victim was encountered. Furthermore, Lundrigan and Canter (2001b) indicated that the home to crime distances will be smaller and the criminal range will be more consistent throughout their series of crimes for offenders of crimes that are rooted in emotion, than for offenders who choose their locations consciously. It could therefore be possible that the home to crime distances of serial killers who leave the bodies on the location where they killed them are shorter and that their criminal range is more consistent, than of the offenders who dispose of their victims' bodies, thus implying some sort of conscious location choice (Lundrigan & Canter, 2001a).

1.1 | Previous study of serial killings by Snook et al.

Snook et al. (2005) in their study of 59 series of solved killings that took place in Germany between 1929 and 1999 found significant relationships between the home to body recovery site distance, age, IQ score, and transport mode. However, it is unclear whether in the case an offender had more than one home location during the series of crimes, the different body recovery sites were connected to the related homes. Furthermore, in their analyses, Snook et al. (2005) did not discriminate between offenders who did and did not dispose of their victims' bodies. However, because choosing to dispose of a body could suggest a more conscious decision-making process, differences could be expected between body-disposing and non-body-disposing serial killers in their travelled distances and in the consistency of their criminal range.

Moreover, 55% of the offenders in the Snook et al. (2005) sample were classified as having a sexual motive, and 42% were classified as having financial gain (robbery) as a motive. In German criminal law, a morally corrupt motive is an integral component of murder that needs to be proved. Sexual lust and greed are explicitly mentioned in the description of the offence as examples of such a motive (Zeimann, 2016). The motives ascribed to the offenders in this sample can be regarded as behavioural characteristics of the offence series, rather than internal or intrinsic motives.

The importance of utilising multiple methodological approaches to unique samples to understand further sexual offending behaviour has been argued for in the literature (Synnott, 2017). With this in mind, findings in crime linkage literature indicate that serial sexual offenders are relatively environmentally consistent within their crime series (Deslauriers-Varin & Beauregard, 2014; Lundrigan, Czarnomski, & Wilson, 2010). Differences in the influence of the type of body recovery site on distances travelled by sexual serial killers and acquisitive serial killers may therefore help to distinguish between these offenders in their location choices, which was not studied by Snook et al. (2005). This study is a progression of the study of Snook et al. (2005) that aims to examine whether there are different processes operating in the crime location choices between body-disposing and non-body-disposing serial killers and between sexual serial killers and acquisitive serial killers.

2 | METHOD

2.1 | Data collection

The data for this study on the abovementioned sample of German 59 series of solved killings were obtained from International Research Centre for Investigative Psychology Archive at the University of Huddersfield. The information consisted of 59 numbered printed maps of different sizes and scales and a document, which will be referred

to as index, containing additional information on the offenders and their offences. Original information required further processing and various distances for each offender such as the mean intercrime distances and the mean home crime distance were calculated. However, as the most reliable crime locations are body recovery sites, because these are usually the only irrefutable crime locations in a murder investigation (Lundrigan & Canter, 2001a, 2001b), for this study only the body recovery sites are used for the analysis.

Moreover, five categories of the body recovery sites derived from the original information, based on the characteristics mentioned in the index, combined with the information on the maps. The first category "Natural environment" consisted of those recovery sites that were, for example, labelled as "woods & meadows," "wood," "forest," "rural cornfield," and "near to a road" in the original material. Those recovery sites that were originally labelled "green space" or "park" were allocated to the second category "Green space in built environment." The third category "Built environment for general use" consisted of those sites situated in an outdoor location in a city, town, or village, such as a street, a car park, or a playground. The fourth category "Built environment for industrial use" consisted of outdoor locations in a built environment such as a factory site, a sewerage plant, a building site, or a rubbish dump. The final category "Indoor" was composed of indoor recovery sites, such as inside a house, a shopping arcade, a railway station, or a train.

Additionally, three categories of marital status derived from the original data: "Single" composed by those marked as "single" and those marked as "divorced" in the original material of the German police; "Married or in a relationship" consisted of those labelled as "married" and "betrothed"; and "Partly married or in a relationship/partly single" were those who were married during a part of the series of crimes and single during another part of the series.

2.2 | Sample

Ten of the 59 series of the sample were excluded from the sample because of the lack of crime locations. All of the offenders in the used sample were male. The age of onset ranged from 16 to 51 with a median onset age of almost 27 ($M = 28.49$, $SD = 9.08$). The minimum number of murders per series was three and the maximum was 15. The median number of crimes was four ($M = 4.59$, $SD = 2.44$). The total number of crimes was 225.

Just over 65% of the offenders were "single." In 32.7% of the series ($N = 16$), the offenders were "married or in a relationship" or "partly married or in a relationship/partly single." In one case, the marital status of the offender was unclear. Additionally, nearly 41% of the offenders were employed or partly employed during the series of offences ($N = 20$, 40.8%), and little over 59% of the offenders was unemployed ($N = 29$, 59.2%). Furthermore, 75.5% ($N = 37$) of the offenders had one home, 14.3% had two homes ($N = 7$), and 10.2% had three homes ($N = 5$) during their crime series.

Of all the murderers, 53.1% ($N = 26$) were classified as having a sexual motive in the original material and are referred to here as sexual serial killers, whereas 42.9% ($N = 21$) of the offenders were deemed to have robbery as a motive and are referred to here as acquisitive serial killers. Only one offender (2%) was classified as having a mixed motive (sexual and robbery), and one offender (2%) was schizophrenic, which according to the original material, obscured his motive.

3 | RESULTS

3.1 | Crime series

In little over 20% of the series ($N = 10$, 20.4%), one or more victims were disposed of at another location than where the murder took place. In 67.3% of the series ($N = 33$), one or more recovery sites were in a natural environment. In 10.2% series ($N = 5$), the murderer left or disposed of a victim in a green space in a built environment. In 36.7% of the series ($N = 18$), one or more recovery sites were in a built environment for general use. Almost 15% of the killers ($N = 7$, 14.3%) left or disposed of a victim in a built environment for industrial use and in more than half of the series one or more recovery sites concerned an indoor location ($N = 27$, 55.1%). For six offences (across four series), the type of recovery site remained unclear (see Table 1).

TABLE 1 Frequencies of the characteristics of the crime series

Variable	Frequency	Percentage
Recovery site vict. house (N = 49)		
Yes	24	49
Recovery site offend. house (N = 49)		
Yes	1	2
Recovery site differs murd. site (N = 49)		
Yes	10	20.4
Recov. site = Natural environ (N = 49)		
Yes	33	67.3
Recov. site = Green space (N = 49)		
Yes	5	10.2
Recov. site = Built env. gen. use (N = 49)		
Yes	18	36.7
Recov. site = Built env. ind. use (N = 49)		
Yes	7	14.3
Recov. site = Indoors (N = 49)		
Yes	27	55.1

3.2 | General results

The variation in the home to crime distances between different homes was investigated in order to use the appropriate home to crime distance measures in the analyses. Furthermore, the results for the whole sample on the size and the consistency of the criminal range and the influence of the type of body recovery site on the home to crime distances are discussed.

3.2.1 | Variation in home to crime distances between different homes

Because 24.5% (N = 12) of the offenders had two (N = 7) or three homes (N = 5) during their crime series, three variables were computed for the median distances between Homes 1, 2, and 3 and the crimes related to those homes. A Friedman test showed that there was a significant difference in median home to crime distances between the different homes, $N = 5$, $\chi^2(2) = 8.4$, $p = 0.015$. Because tests revealed that the distributions of the median distances of these three groups were not symmetrical, sign tests were used to examine which of the differences in distances were significant. A Bonferroni correction was applied, resulting in a significance level of 0.016. The post hoc tests did not reveal which of the distances differed significantly between different homes and their related crimes. Results from the Friedman test indicated that the distances offenders travelled to their crimes differed between homes.

Spearman's rank-order correlation tests (N = 49) revealed that there were no significant correlations between the number of homes and the median distances from Homes 1, 2, and 3 to their related crimes (see Table 2), indicating that the variation was not affected by the number of homes the offender had during the series. It also confirms the results of the Friedman test in that the distances from H1, H2, and H3 to their related crimes are not correlated with each other.

Although the number of offenders with two (N = 12) and with three homes (N = 5) was relatively small, a new variable was computed for the overall median distance between the homes of the offenders and the crimes related to these homes, in order to avoid distortions due to multiple homes. The overall median for the whole sample ranged from 0.70 km to almost 300 km. The median value of the overall median was also calculated and was found to be 11.05 km (see Table 3).

TABLE 2 Correlations between number of homes and the median distances between homes and related crimes

Variable	Number of homes	Mdn H1 to related crimes	Mdn H2 to related crimes	Mdn H3 to related crimes
Number of homes	—			
Mdn H1 to related crimes	0.01	—		
Mdn H2 to related crimes	−0.07	0.04	—	
Mdn H3 to related crimes	0.00	−0.10	0.20	—

TABLE 3 Travelled distances in kilometres for the whole sample ($N = 49$)

Variable	Mdn	M	SD	Min	Max
Overall median homes to related crimes	11.05	30.66	62.41	0.70	297.85
Distance between two furthest crimes	30.03	74.99	133.27	1.45	630.83
Median intercrime distance	19.90	49.25	94.76	0.87	433.43
Furthest home to related crime distance	22.04	62.50	114.70	1.70	491.57

3.2.2 | Criminal range

The distance between the two furthest crimes was used as an indicating measure for the criminal range, because it forms the diameter of the area that circumscribes all crimes of the offender, and furthermore, it is not influenced by whether or not the offender lives close to his crime locations. The distance between the two furthest crimes ranged from nearly 1.5 km to little over 630 km, with a median of 30.03 km.

As mentioned previously, the correlation between the intercrime distance and the largest home to crime distance can be used as an indicator of the consistency of the criminal range. Therefore, two new variables were created: the median intercrime distance and the largest home to its related crime distance. The median of the intercrime distance ranged from little less than 1 km to almost 435 km, with a median value of 19.90 km. The distance from home to the furthest crime ranged from little over 1.5 km to little over 490 km, with a median of 22.04 km. A Spearman's rank-order correlation test showed that there was a significant strong positive relationship between the median intercrime distance and the largest distance from the home to its related crime ($r_s = 0.78$, $p < 0.01$), indicating that the criminal range was consistent for this sample.

3.2.3 | Influence of type of body recovery site on home to crime distances

There was a weak positive relationship between the overall median of the distances between homes and their related crimes and the recovery site being in a natural environment ($r_s = 0.36$, $p < 0.05$), according to a Spearman's rank-order correlations test ($N = 49$). Furthermore, two weak negative correlations were found between the overall median and the recovery site being in a green space in a built environment ($r_s = -0.41$, $p < 0.01$) and an indoor recovery site ($r_s = -0.34$, $p < 0.05$). The other relationships between the travelled distances and the types of recovery site were not significant (see Table 4).

3.3 | Variations between body-disposing and non-body-disposing serial killers

See Tables 5 and 6 for the descriptive statistics and the frequencies for body-disposing and non-body-disposing killers.

TABLE 4 Correlations between overall median homes to related crimes and types of recovery site

Variable	Mnd homes crimes	Nat. environm	Green space	Built gen. use	Built indus. use	Indoors
Mdn homes crimes	—					
Nat. environm	0.36*	—				
Green space	-0.41**	-0.24	—			
Built gen. use	-0.04	-0.01	0.19	—		
Built indus. use	-0.10	-0.10	0.05	-0.16	—	
Indoors	-0.34*	-0.77**	0.22	-0.19	0.06	—

*Correlation is significant at the 0.05 level (two-tailed). **Correlation is significant at the 0.01 level (two-tailed).

TABLE 5 Descriptive statistics of age, number of crimes, active period, and number of homes grouped by body-disposing and non-body-disposing killers

Variable	Body-disposers (N = 10)				Non-body-disposers (N = 39)			
	M	SD	Min	Max	M	SD	Min	Max
Onset age	28.40	8.61	16	43	28.51	9.30	17	51
Months active per offender	41.38	49.73	3.70	144	36.80	57.76	0.30	256.80
Number of crimes per series	3.30	0.48	3	4	4.92	2.63	3	15
Average number of days between crimes per series	487.65	497.17	55.50	1,460.67	267.83	334.30	5	1,379.67
Number of homes per offender			1	3			1	3

TABLE 6 Frequencies grouped by body-disposing and non-body-disposing killers

Variable	Body-disposers (N = 10)		Non-body-disposers (N = 39)	
	Frequency	Percentage	Frequency	Percentage
Marital status				
Single	9	90	23	59
Married/in relationship	1	10	11	28.2
Partly single, partly mar/in rel	0	0	4	10.3
Unclear	0	0	1	2.6
Employed				
Yes	6	60	11	28.2
No	4	40	25	64.1
Partly	0	0	3	7.7
Subgroup of serial killer				
Sexual	6	60	20	51.3
Acquisitive	4	40	17	43.6
Mixed (sexual and acquisitive)	0	0	1	2.6
Unknown (schizophrenic)	0	0	1	2.6
Number of homes				
1	7	70	30	76.9
2	2	20	5	12.8
3	1	10	4	10.3

3.3.1 | Home to crimes distances

The median value of the overall median of the distances between homes and related crimes varied between body-disposing and non-body-disposing offenders (see Table 7).

A Mann-Whitney test confirmed that the mean rank of the overall median of the distances between homes and related crimes did not differ significantly between the groups ($N = 49$, $U = 164.00$, $p > 0.05$).

3.3.2 | Criminal range

Although there was a difference in the distance between the two furthest crimes of 6.14 km between the body-disposers and non-body-disposers (see Table 7), a Mann-Whitney test showed that the size of the criminal range did not differ significantly between these groups ($N = 49$, $U = 187.00$, $p > 0$).

A Spearman's correlations test showed that the strong positive relationship between the median intercrime distance and the largest home to its related crime distance was slightly stronger for body-disposers ($N = 10$, $r_s = 0.82$, $p < 0.01$) than for the non-body-disposers ($N = 39$, $r_s = 0.79$, $p < 0.01$). It can therefore be inferred that the criminal range was slightly more consistent for body-disposing offenders (see Table 7).

3.4 | Variations between sexual and acquisitive serial killers

The descriptive statistics and the frequencies for sexual serial killers and acquisitive serial killers are provided in Tables 8 and 9.

TABLE 7 Travelled distances in kilometres grouped by body-disposing and non-body-disposing killers ($N = 49$)

Variable	Mdn	Body-disposers ($N = 10$)				Mdn	Non-body-disposers ($N = 39$)			
		M	SD	Min	Max		M	SD	Min	Max
Overall median homes to related crimes	12.16	13.28	6.35	3.69	22.42	11.05	35.13	69.36	0.70	297.85
Distance between two furthest crimes	36.47	44.49	34.33	3.37	97.48	30.33	82.82	147.81	1.45	632.28
Median intercrime distance	26.40	34.37	29.38	1.75	96.83	17.26	53.06	105.19	0.87	433.43
Furthest home to related crime distance	24.95	29.97	27.79	6.26	99.31	20.20	70.84	126.83	1.70	491.57

TABLE 8 Descriptive statistics of age, number of crimes, active period, and number of homes grouped by sexual and acquisitive killers

Variable	Sexual ($N = 26$)				Acquisitive ($N = 21$)			
	M	SD	Min	Max	M	SD	Min	Max
Onset age	25.85	7.68	16	46	31.50	9.11	20	51
Months active per offender	47.35	58.74	2.70	256.80	22.75	47.39	0.30	216.50
Number of crimes per series	5.23	2.89	3	15	3.52	1.12	3	7
Average number of days between crimes per series	395.10	428.54	19.79	1,460.67	206.72	284.59	5	1,098.50
Number of homes per offender			1	3			1	2

TABLE 9 Frequencies grouped by sexual and acquisitive killers

Variable	Sexual (N = 26)		Acquisitive (N = 21)	
	Frequency	Percentage	Frequency	Percentage
Marital status				
Single	18	69.2	13	61.9
Married/in relationship	6	23.1	6	28.6
Partly single, partly mar/in rel	2	7.7	2	9.5
Unclear	0	0	0	0
Employed				
Yes	12	46.2	5	23.8
No	13	50	15	71.4
Partly	1	3.8	1	4.8
Body-disposer				
Yes	6	23.1	4	19
No	20	76.9	17	81
Number of homes				
1	20	76.9	16	76.2
2	2	7.7	5	23.8
3	4	15.4	0	0
Recov. site = Natural environ				
Yes	20	76.9	13	61.9
No	6	23.1	8	38.1
Recov. site = Green space				
Yes	3	11.5	0	0
No	23	88.5	21	100
Recov. site = Indoors				
Yes	10	38.5	15	71.4
No	16	61.5	6	28.6

3.4.1 | Home to crimes distances

The median value of the overall median of the distances between homes and related crimes varied slightly between sexual and acquisitive serial killers. However, a Mann–Whitney test indicated that the difference was not significant ($N = 47$, $U = 246.00$, $p > 0$).

3.4.2 | Criminal range

The variation between the two groups of offenders in the median distance between the two furthest crimes is 16.94 km (see Table 10). However, using a Mann–Whitney test, the difference between sexual serial killers ($N = 26$) or acquisitive serial killers ($N = 21$) was found to be not significant ($N = 47$, $U = 224.5$, $p > 0.05$). This indicates that the criminal ranges of these groups of offenders were equal in size. A Spearman's correlations test showed that the strong positive relationship between the median intercrime distance and the largest home to its related crime distance was slightly stronger for sexual serial killers ($N = 26$, $r_s = 0.76$, $p < 0.01$) than for acquisitive serial killers ($N = 21$, $r_s = 0.74$, $p < 0.01$). This indicates that criminal range was slightly more consistent for sexual serial killers (see Table 10).

TABLE 10 Travelled distances in kilometres grouped by sexual and acquisitive killers (N = 47)

Variable	Sexual (N = 26)					Acquisitive (N = 21)				
	Mdn	M	SD	Min	Max	Mdn	M	SD	Min	Max
Overall median homes to related crimes	11.36	39.21	77.26	.96	297.85	11.05	22.87	40.52	1.27	163.73
Distance between two furthest crimes	45.01	91.30	153.23	1.83	632.28	28.07	61.07	110.85	1.95	503.73
Median intercrime distance	21.10	54.59	105.12	1.13	433.43	17.44	46.66	86.67	1.75	397.76
Furthest home to related crime distance	28.08	71.21	120.39	1.70	481.05	17.24	56.94	114.11	1.76	491.57

TABLE 11 Nonsignificant Mann–Whitney tests within groups

Variable	Group	Difference within groups between		Mann–Whitney	Sign
Overall median dist. homes to related crimes	Natural environment	Sexual	Acquisitive		
	Yes	16.85 (N = 20)	17.33 (N = 13)	127.00	>0.05
	No	7.83 (N = 6)	7.25 (N = 13)	22.00	>0.05
	Green space built Env	Sexual	Acquisitive		
	Yes	2.00 (N = 3)	— (N = 0)	—	
	No	24.52 (N = 23)	20.29 (N = 21)	195.00	>0.05
Indoor location	Yes	14.10 (N = 10)	12.27 (N = 15)	64.00	>0.05
	No	10.94 (N = 16)	13.00 (N = 6)	39.00	>0.05

3.4.3 | Types of body recovery sites

No significant differences between sexual and acquisitive serial killers were found within the groups of body recovery sites (see Table 11).

4 | DISCUSSION

This study aimed to investigate whether there were different processes operating in the crime location choices between body-disposing and non-body-disposing serial killers and between sexual and acquisitive serial killers. Therefore, variations in home to body recovery site distances and in size and consistency of the criminal range between those groups of offenders were examined, as well as the relationships between home to crime distances and types of body recovery sites. Also, the variation in the home to crime distances between different homes was investigated in order to use the appropriate measures in the analyses.

Although the number of offenders with three homes was relatively small, significant variation was found in the home to crime distances between the different homes. Therefore, the overall median of the distances between homes and their related body recovery locations was used in the subsequent analyses. The general results of this study confirm earlier findings on the distances serial killers travel from home to crime and the size of their criminal range. The type of body recovery site was only positively correlated to the travelled home to crime distances of the whole sample when the recovery location was in a natural environment. The body recovery site, being in a green space, in a built environment, and at an indoor location, correlated negatively with the home to crime distance.

No significant differences were found in the overall median of the distances between homes and their related body recovery locations between body-disposing and non-body-disposing serial killers and between sexual and acquisitive serial killers. Furthermore, the differences in the size of the criminal range between the compared groups

were not significant and its consistency varied only slightly between the groups. Moreover, the types of body recovery site did not correlate with the home to crime distances for the sexual and acquisitive serial killers. These results suggest that body-disposing and non-body-disposing serial killers and sexual and acquisitive serial killers do not seem to constitute subtypes of serial killers regarding their spatial behaviour.

4.1 | General findings

In the current study, the overall median (11.05 km) was found to be 4.55 km larger than the 6.5 km that was reported by Snook et al. (2005). Although the same sample was used for both studies, with only a small difference in size ($N = 49$ and $N = 53$, respectively), the difference could be explained by differences in the calculation of the median, because of the variation found in the home to crime distances between different homes. The median distance travelled by the murderers of the sample of the current study sits however in the middle of the median home to crime distances of 15 km for U.S. serial killers and 9 km for serial killers from the United Kingdom that Lundrigan and Canter (2001b) found. This indicates that compared with offenders of other types of crime, the German serial killers are similar to serial killers of other samples in the relative large distances they travelled from home to crime location (Lundrigan & Canter, 2001a).

The median size of the criminal range was just over 30 km. Both these findings for this sample indicate that the geographical footprint of German serial killers covers a relatively small area, although still larger than that of offenders of other types of crime (Lundrigan & Canter, 2001b). Additionally, the criminal range of the whole sample was found to be highly consistent. This observation confirms earlier findings that offenders are consistent in their travelled distances (Canter & Youngs, 2009; Lundrigan & Canter, 2001a).

The finding that the home to crime distances differed between homes could indicate that the different homes have different psychological meanings to the offenders. Bernasco (2010) found that offenders tend to offend initially closer to their previous home than to their current home, however that reverses over time. The author explains this by assuming that the previous home remains to play a central role in offenders' life for some time.

Considering the median home to crime distance of approximately 11 km, the home might have played an important role in the offenders' locations choices. Nevertheless, regardless of however valuable the current findings may be for the knowledge about spatial behaviour of German serial killers, they do not explain why serial killers offend relatively further away from their homes than other offenders. Although Lundrigan and Canter (2001b) argued that the median home to crime distance for their sample of serial killers was relatively large but still indicated that they were offending within a familiar area. Canter and Youngs (2009) argued that the perceptions of the environment could be explained by the cognitive process of the creation of a mental map of the environment with an image of the perceived opportunities.

The body recovery site being located in a natural environment correlated positively with the home to crime distance, whereas it being in a green space, in a built environment, and at an indoor location correlated negatively with the home to crime distance. This is not surprising, because offenders operating in rural environments were found to travel further from home than those operating in urban environments (Häkkinen, Hurme, & Liukkonen, 2007; Van der Kemp & Van Koppen, 2007).

4.2 | Body-disposers and non-body-disposers

Between the groups of body-disposing and non-body-disposing offenders, no significant differences were found in home to crime distances and in the size of the criminal range. The strong positive correlation between the median intercrime distance and the largest home to its related crime distance was only slightly stronger for body-disposers, which indicates that they were slightly more consistent in their criminal range than non-body-disposers. This seems to contradict the idea that body-disposers make a more conscious location choice than non-body-disposers, because

offenders of crimes that are more rooted in emotion are thought to have a more consistent criminal range (Lundrigan & Canter, 2001a, 2001b; Snook et al., 2005). However, the difference in consistency between the two groups was minimal.

Taken together, the results indicate that the distinction between body-disposing and non-body-disposing offenders is not indicative of a distinction in crime location choices for German serial killers. In other words, they cannot meaningfully be categorised as two distinct groups of offenders regarding their spatial behaviour. This might be unexpected, because several studies suggest that disposing of a body at another location than where the murder took place points to a more or less conscious spatial decision (Lundrigan & Canter, 2001a; Snook et al., 2005), which could be different for killers who leave the body behind on the murder location. Furthermore, it seems likely that an offender who disposes of one or more of the early victims, but not of later victims, is making a conscious choice to leave the later victim on the murder site than if an offender did not dispose of any of his victims at all. Perhaps those who started disposing of the victims at a later point in their series had learnt from their earlier experience and started disposing the bodies at consciously chosen locations to avoid apprehension (Canter, 2004). However, because all offenders who disposed of one or more victims were considered body-disposers, the results of the current study may indicate an evenly conscious decision-making process for non-body-disposing offenders, which would support the idea that planning plays an important part in serial killers' location choices.

It should be noted that the results are to be treated with caution, because the home to disposal site distances were not compared with home to murder site distances, which could have distorted the home to recovery site distances for body-disposing offenders who did not dispose of all his victims' bodies. Therefore, the results only concern differences in home to body recovery site distances between offenders who did and who did not dispose of one or more of their victims, and they do not involve differences in home to disposal site distances and home to murder site distances.

4.3 | Sexual and acquisitive serial killers

No significant differences were found between sexual and acquisitive serial killers in the overall median of the distances between homes and their related crimes. The absence of significant variation between the offender groups confirmed the findings of Snook et al. (2005) study who found no relationship between "motive" and the home to crime distances.

Because offenders are usually consistent in the distances they travel from their homes to their crime locations (Canter & Youngs, 2009; Lundrigan & Canter, 2001a) and the size of the criminal range did not differ significantly between sexual and acquisitive killers, it is not surprising that only a minor difference was found in the relatively high consistency of the criminal range between these offenders.

Taken together, the only difference in spatial behaviour between the two groups of offenders is that the acquisitive serial killers were found to be slightly more consistent in their criminal range. These results suggest therefore that sexual serial killers and acquisitive serial killers do not constitute distinct subgroups of serial killers with regard to their spatial offending behaviour. This might be surprising, because of the differences found in travelled distances between offenders of different types of crimes (Canter et al., 2000; Canter & Youngs, 2009; Levine, 2009), which suggests that the type of crime itself is related to distances travelled. The differentiating behaviours of both groups of serial killers are however not indicative of differences in spatial behaviour. This suggests that both groups of serial murderers are possibly subjected to the same factors that influence their spatial behaviour and that they do not constitute subtypes. However, it has been reported (Youngs, Ioannou, & Eagles, 2016) that specialisation is represented through expressive and instrumental offenders, although if this relates to geo-behaviour remains unclear. It would be useful to examine the criminal narratives of these two groups of offenders as has been successfully applied in other studies (Ioannou, Canter, Youngs, & Synnott, 2015; Ioannou, Canter, & Youngs, 2017; Ioannou, Hammond, & Simpson, 2015; Ioannou, Synnott, Lowe, & Tzani-Pepelasi, 2018; Ioannou, Synnott, Reynolds, & Pearson, 2018;

Yaneva, Ioannou, Hammond, & Synnott, 2018). This would be in respect to their geographic profiles to ascertain if the lack of variation in geographic behaviour is consistent in their offender narrative.

The results also suggest that the similarities between both groups of serial killers might also be indicative of a similar type and level of emotional involvement. According to Meloy (2000), a sexually motivated serial killing is unusual in that it combines the relational aspect of sexual crimes against strangers with the aspect of violent crimes that are usually committed against victims who are well known to the offender. This could however also be true for serial killings committed together with other offending behaviour where usually strangers are targeted, like acquisitive crimes. It highlights therefore the seemingly important feature of serial killing that it comprises violence against strangers of which the main goal seems to be the violence itself, irrespective of the additional offending behaviour that accompanied the killings. This is in line with the findings of Salfati and Bateman (2005) that, although sexual acts which were found to be an expression of instrumental aggression were highly frequent in their sample, the majority of serial killings were predominately expressive. As mentioned before, expressive crime is associated with the main objective of harming the victim, and the victim is thought to be of great importance to the offender (Salfati & Bateman, 2005; Santtila et al., 2008).

Although Lundrigan and Canter (2001b) argued that the majority of the U.S. and U.K. serial killers most likely acted more strongly upon routine activity than on rational choice, which is consistent with the thought that these crimes are more rooted in emotions, this seems to contradict the fact that the distances serial killers travel are generally found to be much greater than those of other offender types (Lundrigan & Canter, 2001a). Salfati and Bateman (2005, p. 130) state however that emotions involved in serial killings: "may be more related to the psychological gratification that the offender may gain from the event taking place and are therefore more active after the offence rather than a precipitating factor." This can also be related to the finding that choices can be influenced by anticipated emotions (Mellers, Schwartz, & Ritov, 1999; Mosier & Fischer, 2010). Therefore, the role of anticipated emotions in decision making might help to explain the relatively great distances the offenders travel better than routine activity approaches, and it also highlights the relatively big role planning possibly plays in serial killings. One way to examine this further would be to look at any of the writings of the offenders to link into their offenders narratives. Emerging research has shown the utility of examining notes and or written contact to build both victim and offender profiles (Ioannou & Debowska, 2014; Synnott, Coulias, & Ioannou, 2017; Synnott, Ioannou, Coyne, & Hemingway, 2017). The finding of the current study that the two groups do not form subgroups of serial killers regarding their spatial behaviour is not consistent with the findings of Salfati and Bateman (2005), in the sense that they found that sexual acts fell into the category of instrumental behaviours and stealing objects from the victim was found to be an expressive behaviour. However, the role of emotion and planning could not be investigated in this study and further research on the meaning of sexual and acquisitive offending behaviours for serial killers could clarify the role emotions play in the processes that influence location choices.

Furthermore, only one offender (2.6%) displayed both sexual and acquisitive offending behaviour together with his murders. That indicates that German serial killers tend to be consistent in their offending behaviour. Therefore, although the finding that sexual serial killers and acquisitive serial killers cannot be considered subgroups might not have much value for the practical application of geographical offender profiling, the fact that the killers in this sample were apparently consistent in their offending behaviour, may be of help to crime linkage research. One area of future research worth examining is the refinement of distance measures to get more accurate figures, such as the use of route distance, now easily calculatable via readily available software compared with previously used crow flight distance that will always underestimate the distance travelled (Synnott, 2013).

5 | CONCLUSION

In short, the current study showed that considering spatial behaviour, the German sample for body-disposing and non-body-disposing killers are not subtypes of serial killers, which suggests that they may make equally conscious

decisions in choosing crime locations. Furthermore, sexual serial killers and acquisitive serial killers do not seem to constitute subgroups of the German sample in terms of their spatial behaviour. This implies that these behaviours might play an ancillary role to the offender. Future research should focus on models in which both the role of planning or conscious decision making and the role of emotions—and especially that of anticipated emotions—are incorporated. Additionally, the results indicate that German serial killers are relatively consistent in their—admittedly broadly categorised—types of behaviour that accompanied the killings. This could be of value in crime linkage research on serial killings; however, further research on behavioural consistency regarding these behaviours is needed.

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